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Computer simulation of observations of stars from the moon using the polar zenith telescope of the Japanese project ILOM

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Abstract

The paper briefly describes the purpose and features of the Japanese project ILOM (In-situ Lunar Orientation Measurement) in which it is planned to install the zenith telescope with a CCD lens on one of the poles of the Moon for the observation of stars in order to determine the physical libration of the Moon (PhLM). The studies presented in this paper are the result of the first stage of the theoretical support of the project: (1) The compilation of the list of stars within the field of view of the telescope during the precessional motion of the lunar pole. (2) Modeling and analysis of the behavior of stellar tracks during the observation period. (3) Simulation and testing of the sensitivity of the measured selenographic star coordinates to changes in the parameters of the dynamic model of the Moon and the elastic parameters of the lunar body. Direct and inverse PhLM problems are discussed. Within the scope of the direct problem visible "daily parallels" and one-year star tracks are calculated. Their behavioral features when observed from the lunar surface are shown. At this stage of the simulation selenographic star coordinates for the four models of the gravitational field of the Moon have been compared, i.e., the model constructed on the basis of the lunar laser ranging (LLR), GLGM-2, LP150Q, and SGM100h. It is shown that even when comparing modern models LP150Q and SGM100h stellar tracks differ from the arc by more than 10 ms of arc. At the stage of the inverse problem, the manifestation of viscoelastic properties of the Moon in selenographic coordinates has been studied. In the spectrum of the simulated residual differences harmonics have been identified which can serve as indicators to refine parameters, Love number k 2 and the delay time characterizing the viscous properties of the lunar body.

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